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Review Article

Twenty-five years of Neobiota: building a community for invasion science in Europe and beyond

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Abstract

While the influential role of scientific associations in shaping research fields is well recognized, their impact within the domain of invasion science remains underexplored. This review combines qualitative narrative with quantitative metrics to trace the development of Neobiota, the first European non-profit and non-governmental scientific association dedicated to the study of biological invasions. Since its foundation in 1999, the Neobiota network has aimed to foster scientific exchange and collaboration, advance and integrate research across all dimensions of invasion science, and disseminate findings to support evidence-based policies. Evolving rapidly from a German working group into Europe's leading network for invasion science, Neobiota has united researchers and practitioners across disciplines, taxa, and national boundaries. In contrast to many other associations, Neobiota operates with a low-threshold, non-bureaucratic governance model, promoting inclusivity and cross-border engagement. We document how its biennial conferences—hosted in 12 European countries between 2000 and 2024—have supported thematic diversity (ranging from molecular biology to socio-economy), increasing international participation (9–47 countries globally), and active policy outreach. Thematically, the focus of research presented at conferences has shifted over time from ecological patterns and species inventories to environmental impacts, predictive modeling, management strategies, and socio-political dimensions of invasions. Trends in equity reveal progress toward gender parity among keynote speakers and session chairs. Neobiota has also supported the dissemination of knowledge through two publication platforms: the Neobiota series (2000–2008) and the open-access, peer-reviewed journal NeoBiota launched in 2011. This journal currently operates under an Editorial Board with 75 subject editors and a team of five Co-Editors-in-Chief. We conclude that over the past 25 years, Neobiota has been instrumental in building a cohesive and inclusive scientific community globally, advancing and disseminating interdisciplinary research on biological invasions, and informing policy, particularly in support of legal frameworks to prevent and mitigate the negative impacts of non-native species.

Key words: Alien species, biological invasions, environmental impacts, environmental management, international cooperation, non-native species, research topics, science-policy interface, scientific associations, scientific conferences

Introduction

Scientific associations or learned societies have driven scientific progress since the late 17th century by fostering idea exchange, building scholarly networks, and connecting research with policy and society (Cohen et al. 1954; Delicado et al. 2014; Boncourt et al. 2023; Bigg et al. 2023). From the early 19th century onward, as scientific disciplines proliferated and specialized, new associations sprang up to reflect emerging fields. However, invasion science, i.e., the interdisciplinary study of the causes and consequences of species introductions beyond their native ranges and the management of their impacts (Richardson 2011a), lacked a dedicated international association until the end of the 20th century. Individual researchers studying invasive species had engaged with broader biological and ecological societies, but it was only in 1999 that Neobiota emerged as the first independent, interdisciplinary association solely devoted to biological invasions (Kowarik and Starfinger 2009).

Earlier organizations addressed selected invasion topics mostly under the banners of weed research and plant health at national scales, such as in the USA (Zimdahl 2010), but also internationally (Chandrasena and Rao 2017; Froud-Williams 2017; Young et al. 2023). The plant health sector was instrumental in the early development of policies and tools such as risk assessments. The International Plant Protection Convention, adopted in 1951, defines plant pest very broadly so that it is almost completely congruent with the term invasive alien species (Starfinger and Schrader 2021). Other cross-border institutions include CABI (founded 1910), the International Organization for Biological Control (IOBC 1955), the Asian-Pacific Weed Science Society (APWSS 1967), the European Weed Research Society (EWRS 1975), and the International Weed Science Society (IWSS 1975). Unlike these bodies, Neobiota embraces the full spectrum of invasion science, without an exclusive focus on species causing economic impacts. In 2016, another association with an international scope emerged in the field: the "International Association for Open Knowledge and Open Data on Invasive Species"—termed "INVASIVESNET" (Lucy et al. 2016).

The conceptual foundations of invasion science date back to 19th-century Europe, when Hewett Watson and Alphonse de Candolle developed early classification schemes for non-native plant species (Trepl 1990; Chew 2011). The Swiss botanist Albert Thellung subsequently catalogued introduction pathways and anticipated many elements of contemporary frameworks on invasion processes (Kowarik and Pyšek 2012). Before this, Charles Darwin had noted severe impacts on biota of oceanic islands in "The Origin of Species" and addressed important features of invasion processes (Ludsin and Wolf 2001). Yet until the mid-20th century, concerns about non-native species were not a key topic of scientific interest (Simberloff 2013).

A paradigm shift occurred in 1958 with Charles Elton's seminal monograph "The Ecology of Invasions by Animals and Plants" (Elton 1958). It recognized biological invasions as a major ecological issue and documented their evolutionary, health, and economic repercussions from a global perspective (Richardson and Pyšek 2008; Richardson 2011b). Elton broadened the focus from plants to all taxa and ecosystems, emphasizing negative impacts. A further catalyst arrived in 1982, when

the Scientific Committee on Problems of the Environment (SCOPE) launched its program on biological invasions, officially convening in 1983. SCOPE's initiative embraced all taxa, ecosystem types, and biogeographical regions, ushering invasion science into mainstream ecology (Drake et al. 1989; Pyšek et al. 2006; Simberloff 2011). Today, invasion science is truly interdisciplinary, integrating genetics, population and evolutionary biology, community and landscape ecology, and socio-economic research and policy (Kueffer et al. 2013; Vaz et al. 2017; Pinto et al. 2022).

Since 1999, Neobiota has distinguished itself as Europe's independent scientific association for invasion science. Through biennial conferences, dedicated publication outlets, and engagement with policymakers and the public, Neobiota mirrors other learned societies in promoting community building, knowledge dissemination, and science-policy dialogue (Bigg et al. 2023). This review aims to contribute to the field from what Delicado et al. (2014) referred to as a perspective of "internal reflexivity," where the history of the association is analyzed not by external historians or sociologists, but by individuals who have been directly involved in its formation and development. We combine this perspective with quantitative analyses, aiming to:

1. Trace Neobiota's foundation, objectives, governance, and development since 1999.
2. Analyze the development of NEOBIOTA conferences, including geographical distribution, scale, home countries of contributors, thematic focus of presentations, equity issues, and policy outreach.
3. Assess Neobiota's contributions to knowledge dissemination through its publication outlets.

Methods

Information on Neobiota's formation and governance was obtained from the personal archives and personal information of founding members and organizational reports (Kowarik and Starfinger 2009). Conference materials—including programs, abstract books, and proceedings—were supplemented with unpublished data provided by local organizers, particularly participant lists.

We used the Books Ngram Viewer, available at http://books.google.com/ngrams, to analyze the use of the term "neobiota" in 2000–2020, based on publications in English in the Google Books database (Madsen and Slåtten 2022). To detect trends over the past 25 years, oral presentation abstracts (except keynotes; n = 884) of the NEOBIOTA conferences were reviewed and classified by some of the authors. The classification included field (ecological, social, or interdisciplinary—where "social" refers to studies on how people cause biological invasions, conceptualize and perceive them, or are affected by or respond to them; Shackleton et al. 2019); geographic scale (local, national, or international); topic (pathways of introduction, species traits, establishment and spread, distribution, impacts, policy, management, or social dimensions); approach (observational, manipulative, secondary data, or theoretical); habitat (aquatic or terrestrial); and taxon (bacteria and fungi, algae, plants, mollusks, arthropods, fishes, amphibians and reptiles, birds, or mammals). Information on participant counts, country affiliations, keynote contributors, and session chairs was also collected. The countries of the authors' first affiliated institutions were differentiated according to the World Bank classification into high-income and less-wealthy countries.

In this article, spellings of the term "neobiota" deliberately vary by context as outlined in Table 1.

Table 1. Different use of the neobiota term in this article, illustrated by varying spelling.

Term	Description	Reference
Neobiota	European Association on Biological Invasions, founded as a German working group in 1999	Kowarik and Starfinger 2009, https://neobiotagroup.com
neobiota	Overarching scientific term encompassing all organisms occurring in a region outside their natural range due to human agency (i.e., alien and non-native species)	Kowarik 2002
NEOBIOTA	Conference series (biennial NEOBIOTA conferences on biological invasions)	https://neobiotagroup.com
Neobiota	Publication series with conference proceedings and monographs published by Neobiota in the period 2002–2009.	https://neobiotagroup.com
NeoBiota	Peer-reviewed open access journal, released by Pensoft Publishers in cooperation with Neobiota (since 2011)	Kühn et al. 2011, https://neobiota.pensoft.net

Development of Neobiota as a European scientific association

Since its foundation, Neobiota has evolved from a nationally initiated working group into a Europe-wide scientific association with global cross-taxonomic outreach. From the outset, its mission has been to foster interdisciplinary collaboration, bridge gaps between basic and applied invasion science, and actively engage with policymakers and the broader public. Over time, Neobiota has refined its governance, expanded its geographical scope, and played an increasingly prominent role in shaping the field of invasion science across Europe and beyond.

First steps as a national working group

Dating back to the 19th century (Trepl 1990), research on biological invasions in Germany and elsewhere remained highly fragmented until the late 20th century. Studies tended to focus on single taxonomic groups (plants, animals, microorganisms), specific ecosystem types (terrestrial, freshwater, or marine), or individual methodological perspectives, addressing selected scales from molecular to landscape level. Exchanges between basic and applied research—across agriculture, forestry, plant health, animal health, urban greening, and nature conservation—were limited.

Against this backdrop, Ludwig Trepl and Tina Heger initiated a "Working Meeting on the Coordination of Research on Biological Invasions, Neophytes, and Neozoa in Germany" on April 9–10, 1999, at the Institute for Ecology of the Technische Universität Berlin – an institution with a long research tradition in studying non-native plant species (Sukopp 1966; Kowarik 2023). Twenty-four experts from German universities, research centers, the German Environment Agency, a conservation NGO (Naturschutz International e. V.), and the intergovernmental Centre for Agriculture and Bioscience International (CABI) participated in the meeting hosted by Ingo Kowarik and Herbert Sukopp. Their expertise spanned plant and vegetation ecology, animal ecology, urban ecology, molecular ecology, plant health, taxonomy, landscape planning and design, and biodiversity conservation. At the conclusion of the meeting, the participants agreed to establish an interdisciplinary working group on invasion biology and thus became the founding members of Neobiota (Table 2).

Table 2. List of founding members of Neobiota present at the "Working Meeting on the Coordination of Research on Biological Invasions, Neophytes, and Neozoa in Germany" in April 1999.

Founding member	Institution at the time of Working Meeting
Beate Alberternst	University of Frankfurt
Harald Auge	UFZ Leipzig-Halle
Katharina Dehnen-Schmutz	TU Berlin
Ulrike Doyle	UBA Berlin
Olaf Geiter	University of Rostock
Volker Grimm	UFZ Leipzig-Halle
Tina Heger	TU Munich
Hariet Hinz	CABI Délomont, Switzerland
Herbert Hurka	University of Osnabrück
Ragnar Kinzelbach	University of Rostock
Ingo Kowarik	TU Berlin
Norbert Kühn	TU Berlin
Ekkehard Lux	Naturschutz International e. V.
Henry Mix	Naturschutz International e.V.
Jürgen Priener	Institute for Zoo and Wildlife Research Berlin
Gert Rheinwald	Alexander Koenig Museum Bonn
Matthias Richter	University of Hohenheim
Gregore Schmitz	University of Bonn
Uwe Starfinger	TU Berlin
Thomas Steinlein	University of Bielefeld
Herbert Sukopp	TU Berlin
Ludwig Trepl	TU Munich
Markus Woitke	University of Würzburg
Stefan Zerbe	TU Berlin

At a follow-up meeting on 11 June of the same year, the group adopted the name "Neobiota – Arbeitsgemeinschaft Biologische Invasionen" (Neobiota – Working Group on Biological Invasions); Ingo Kowarik was elected Coordinator and Uwe Starfinger Secretary.

The participants of the founding meetings agreed on Neobiota's four principal objectives:

- Foster scientific exchange and collaboration across the full spectrum of basic and applied research on biological invasions;
- Advance and integrate research on the causes, mechanisms, and ecological impacts of biological invasions and address how to respond to them;
- Translate and disseminate scientific findings into applied disciplines, particularly by highlighting insights into invasion pathways and control strategies; and
- Serve as a bridge between science, policy, and the media, providing expert advice to decision makers and accessible information to the public.

Therefore, from its inception, Neobiota positioned itself as a group corresponding to what Delicado et al. (2014) have addressed as a "scientific society" primarily

dedicated to the development of a research discipline—distinct from professional associations that represent practitioners' interests or from science-communication bodies focused on public outreach. However, these categories overlap in practice (Delicado et al. 2014), and Neobiota early on embraced proactive engagement with both policymakers and broader society, i.e., a commitment that became especially evident at its biennial conferences (Section "Community building").

Defining "neobiota" as a novel term

Terms in invasion ecology have often been criticized for carrying value-laden, militaristic, or xenophobic connotations (Larson 2005; Janovsky and Larson 2019) or selectively addressing distinct groups of non-native taxa such as neophytes for plants and neozoa for animals. Seeking a neutral, inclusive label, the founding members coined the term "neobiota." From that point onward, neobiota referred both to the newly established working group (and its logo; Fig. 1) and, as an umbrella scientific term, to all non-native organisms collectively. Etymologically, the prefix *neo-* denotes novelty or recent arrival, while *biota* encompasses all living organisms. Thus, neobiota were formally defined as "organisms, independent of their taxonomic rank, which occur in a region outside their native range due to human agency, or which evolved from such taxa" (Kowarik 2002, p. 7), i.e., synonymous with other terms used to describe the results of biological invasions, such as alien or non-native (Richardson et al. 2000; Blackburn et al. 2011).

The term also became associated with the publication series and the following open-access journal (Table 1). A search using the Google Books Ngram Viewer

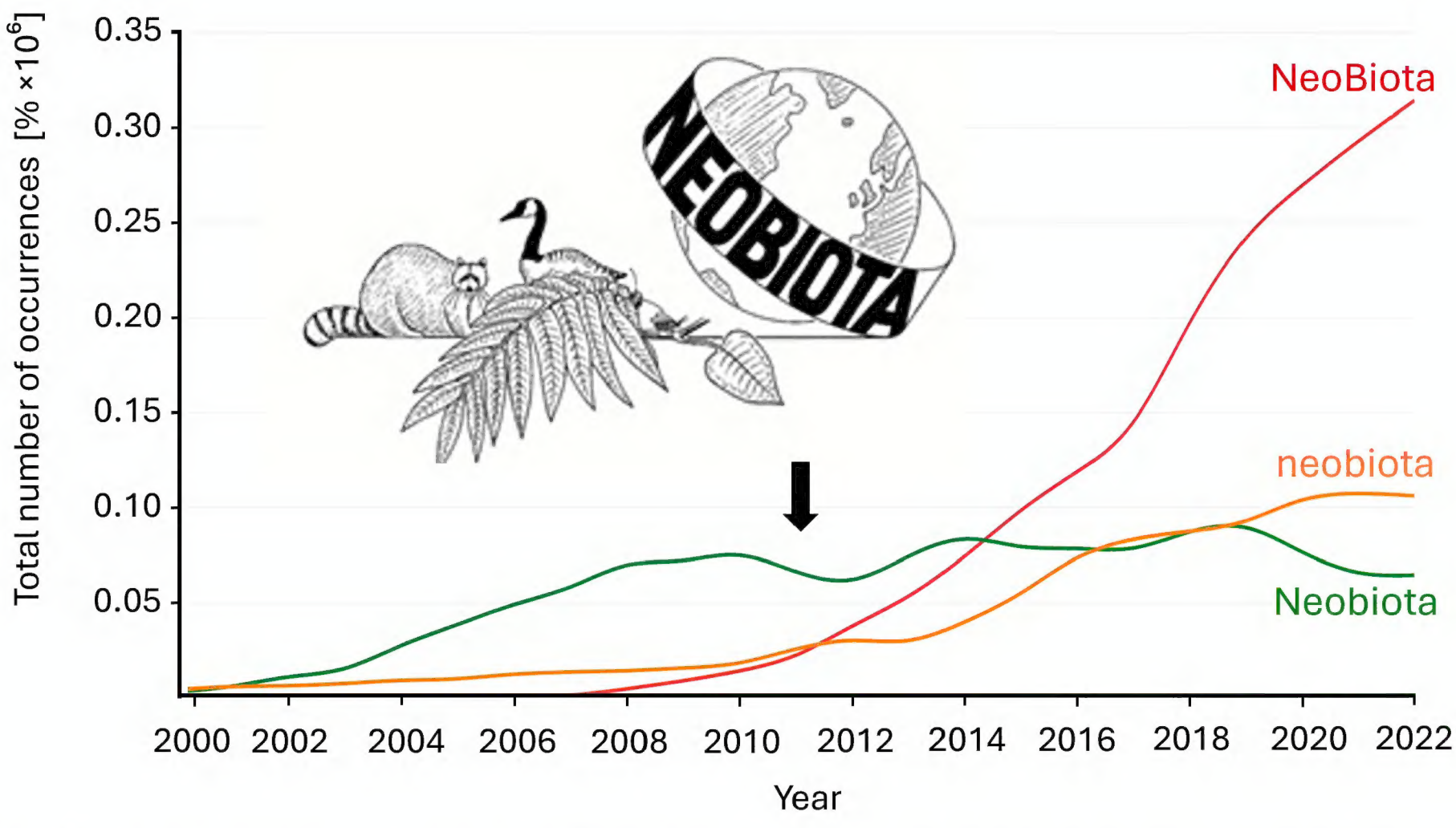

Figure 1. Increased use of the term "neobiota" in publications between 2000 and 2022. The graph shows the annual relative frequency of different spellings (% × 10^6), based on data from the Google Books database (Data source: Google Books Ngram Viewer, available at http://books.google.com/ngrams, retrieved 7 August 2025). The inserted Neobiota logo has been used since 2000; the arrow indicates the year (2011) of the launch of the NeoBiota journal.

shows that the term 'neobiota' has been increasingly used in publications (in English) from 2000 to 2022. In particular, the graph for the spelling 'NeoBiota' highlights a notable increase in references to the NeoBiota journal, which was launched in 2011 (Section "NeoBiota as a new journal"). Like all analyses using the Ngram Viewer, caveats must be considered when interpreting the trends (Madsen and Slåtten 2022). The Google Books database does not encompass all publications from the study period, and the proportion of mentions of the term "neobiota" for a given year provides no insight into the reception of the underlying sources.

Toward a European association with global connections

Unlike many national scientific societies, international research associations have gained prominence over the past century by facilitating cross-border collaboration and knowledge exchange (Delicado et al. 2014). Neobiota completed its transition from a German working group to a Europe-wide association within just a few years.

Its first conference in Berlin (2000) already featured contributions from nine countries, mostly from Central Europe. At the second conference in Halle (2002), with contributions from 12 countries, participants formally resolved to convert Neobiota into a European association and to schedule future meetings outside Germany. In the Halle proceedings, Kühn and Klotz (2004: 1) observed that "Neobiota brought a Central European community of invasion scientists together on a high scientific level. We are confident that the working group Neobiota is on the best way to being a major authority in European plant-invasion studies."

Subsequent developments have far exceeded this early prognosis. A range of taxa beyond plants had been covered from the beginning. By the Bern conference in 2004, Neobiota had redefined itself as a pan-European platform for all aspects of invasion research—while explicitly remaining rooted in Europe by rotating conferences among European host institutions. A key motivation for this European identity was to provide more effective, coordinated expertise to the EU and its member states. At the same time, the NEOBIOTA conferences have been open to participants worldwide, thereby promoting global exchange and networking in invasion science. Participants from 34 non-European countries have participated since the 2002 conference in Halle. The highest number of participating non-European countries was in 2018 and 2024, with 16 each, meaning that in both years over a third of the represented countries were non-European (37% in 2018 and 34% in 2024).

Governance structure

Most scientific associations operate within a formal, hierarchical framework. This typically includes elected leadership bodies, defined membership procedures, a formal constitution or set of bylaws, and a dedicated administrative office to support activities such as conferences, publications, financial reports, and day-to-day operations. These functions are usually financed through membership fees, and many associations acquire legal status through formal registration. Neobiota has followed a different path from the very beginning. The founding members deliberately chose to remain an informal network, i.e., self-defined as the European working group on biological invasions. Membership was informal and has always been open to anyone working in the field, united by a shared commitment to both fundamental and applied invasion science and to related environmental and conservation policy

issues. The European participants of the NEOBIOTA conferences were seen as representative of the membership, which was not formalized further.

This consciously low-threshold and non-bureaucratic model, which eschewed formal registration, membership procedures, and fees, was motivated by two main considerations: minimizing administrative burdens and lowering barriers to participation, thus enabling the formation of an inclusive, interdisciplinary, and cross-border scientific community.

During its first decade, Neobiota gradually developed a governance structure that aimed to reconcile several objectives: external visibility, inclusiveness, representation of the growing European invasion science community, and organizational simplicity (Fig. 2). All roles were honorary and carried out voluntarily (see Table 3 for an overview of the individuals involved).

At the Berlin working meeting in June 1999, a Coordinator was elected, supported by a Secretary. Their joint responsibility was to represent Neobiota externally and to promote its internal development. In the early years, the Coordinator supported the recruitment of local organizers, who then took primary responsibility for hosting the NEOBIOTA conferences. At the Antalya conference in 2014, the role of Coordinator was formally transformed into that of President, and both the President and Vice-President were elected by the Neobiota Board during that meeting. Together with the Neobiota Secretary, who is selected by the President and Vice-President, they act as the Neobiota Executive Committee. The growing size and increasing internationalization of the Neobiota community made it

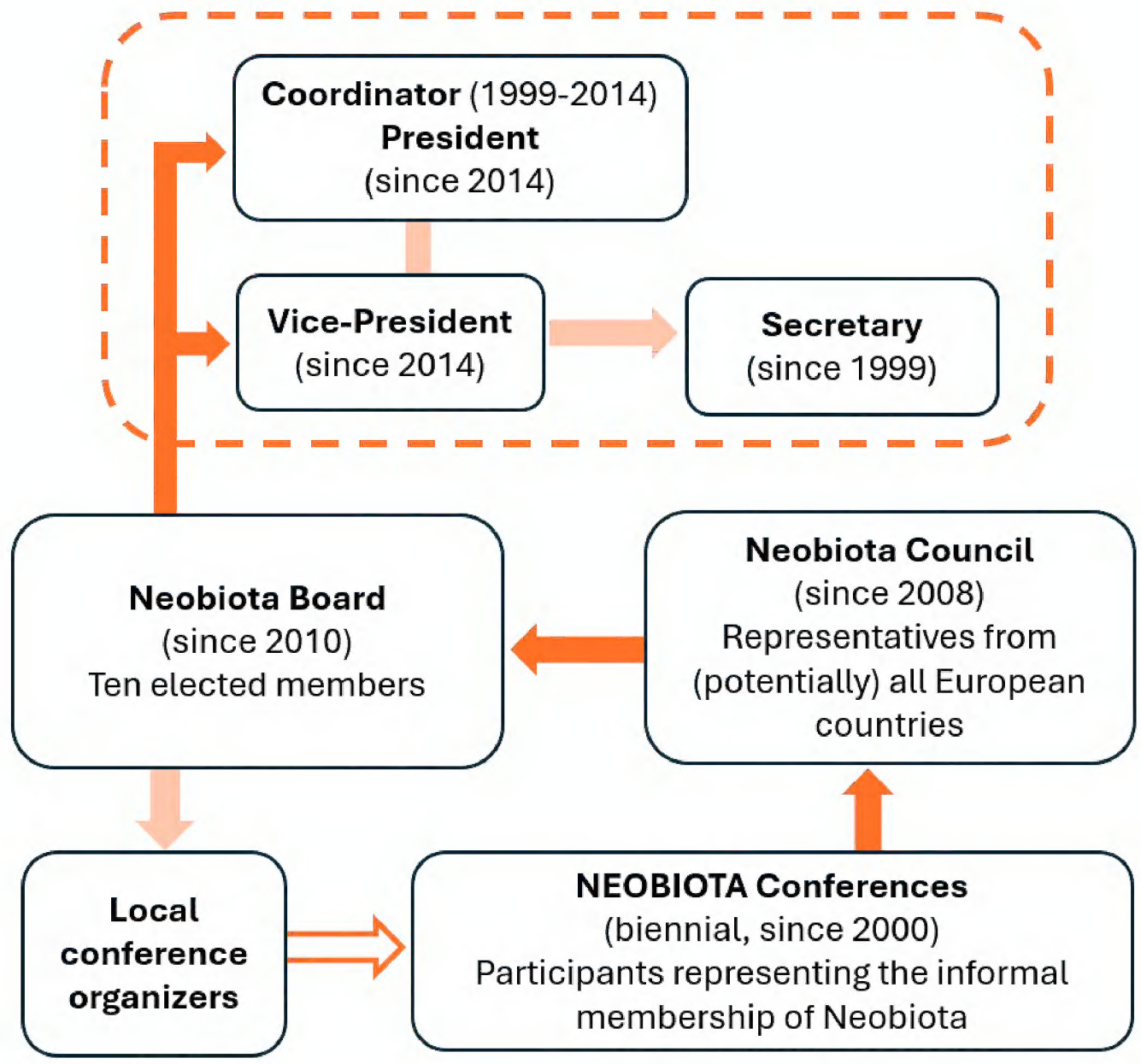

Figure 2. Governance structure of the European working group Neobiota, as it evolved between 1999 and 2014 (arrow coding: dark orange – election, shaded orange – selection, white – organization; the dashed lines indicate the Neobiota Executive Committee).

Table 3. Individuals with key roles in the Neobiota association (1999–2025) and related publication formats (for members of the Neobiota Council, see Suppl. material 1: table S1).

	Coordinator	President	Vice-President	Secretary	Board member	Editors of publications
Ingo Kowarik	1999–2012	2012–2014[a]			Since 2010	2000–2010[b]
Montserrat Vilà		2014–2024	2012–2014		Since 2010	
Franz Essl		Since 2024	2014–2024		Since 2010	
Bellinda Gallardo			Since 2024			
Uwe Starfinger				1999–2022		2000–2010[b]
Ana Novoa				Since 2022		Since 2024[c]
Ingolf Kühn					2010–2024	Since 2011[c]
Petr Pyšek					Since 2010	
Phil Hulme, Andrew Liebhold, Tammy Robinson						Since 2024[c]
Piero Genovensi, Laura Celesti-Grapow, Johannes Kollmann, Wolfgang Nentwig, Wolfgang Rabitsch					2010–2024	
Tim Adriaens, Margarita Arianoutsou-Faraggitaki, Sven Bacher, Giuseppe Brundu, Franz Essl, Belinda Gallardo, Tina Heger, Jan Pergl, Barbara Tokarska-Guzik, Giovanni Vimercati					Since 2024	

[a]Honorary President since 2014; [b]Neobiota series, [c]NeoBiota journal

increasingly important to anchor its coordination more firmly at the European level. To this end, two new governance bodies were introduced starting in 2008, i.e., the Neobiota Council and the Neobiota Board.

The Neobiota Council was designed to include 1–2 delegates from potentially all European countries. The key objective of the Council was to enhance Neobiota's visibility across Europe and, by doing so, to foster the development of national communities in invasion science. The Neobiota Council has the following tasks:

- Representing the European Neobiota association within their respective countries;
- Providing national perspectives, insights, and impulses to support Neobiota's continental agenda; and
- Electing the members of the Neobiota Board.

At the NEOBIOTA conference in Prague in 2008, a Neobiota Council was elected for the first time by conference participants and regularly updated and expanded afterward. To this day, members of the Council have represented a total of 33 European countries (Suppl. material 1: table S1). To broaden the democratic basis of the Council elections, a new election procedure was introduced at the 2016 Vianden conference. From then on, each conference participant from Europe—along with individuals who had attended previous conferences and were listed in the official invitation circular—was entitled to nominate up to two representatives from their country of professional residence, restricted to European countries in a broad sense (including Turkey and the Caucasus countries). Based on these nominations, participants at the subsequent conference could vote to elect two delegates from their respective home countries.

The Neobiota Board was conceived as the association's steering committee, with the tasks of:

- Complementing and supporting the leadership team;
- Electing the President and Vice-President; and
- Deciding on the venues of future NEOBIOTA conferences.

The Neobiota Board was first established at the 2010 Copenhagen conference by electing 10 scientists with recognized expertise in invasion science (Table 3). As of 2025, several founding members of both the Neobiota Council and Board remain actively involved, while others have been succeeded by new members. This ongoing renewal reflects a balance of continuity and generational change, contributing to the sustained vitality and adaptability of Neobiota's governance structure (Table 3).

NEOBIOTA conferences

International scientific conferences have served not only as platforms for scholarly communication and exchange but also as crucial arenas for the formation and consolidation of scientific communities, particularly from the mid-19th century onward (Hauss 2021; Bigg et al. 2023). Despite their significance as a "new form of sociability, as a mode of communication, and as a manifestation of internationalism," they have received limited attention in the historiography of science (Bigg et al. 2023, p. 2).

A notable exception can be found in the field of invasion science, where international conferences on the "Ecology and Management of Alien Plant Invasions" (EMAPi) have been held since 1992, and their history was documented up to 2017 (Pyšek et al. 2019). Since 2000, the NEOBIOTA conferences have taken place in alternating years with EMAPi. In contrast to EMAPi, where the focus is on plants, NEOBIOTA conferences address all taxonomic groups, thereby offering a taxonomically broader scientific framework (see "Scientific contributions and addressed topics" section).

Conference venues and organization

In line with Neobiota's identity as a European association, all of its conferences have taken place in Europe, including Turkey (Fig. 3; Table 4), covering a total of 12 countries. Starting with Berlin in 2000, the next four conferences were also held in Central Europe, i.e., Halle (Germany), Bern (Switzerland), Vienna (Austria), and Prague (Czech Republic). In later years, the geographical scope expanded to include a broad range of European regions, from Ireland and Portugal in the west to Turkey in the southeast and Denmark and Estonia in the north (Fig. 3).

In the early phase, conference locations were selected through informal agreements among members, and since 2010, through agreements among NEOBIOTA's Board and Council members. Since 2025, the upcoming venues have been selected by the Neobiota Board to ensure strategic planning and broader regional representation.

The geographical location of venues has served three key purposes: (1) To foster a pan-European scientific community by encouraging the participation of new (informal) members and strengthening international cohesion; (2) to enhance the visibility of local research communities in the respective host countries; and (3) to promote the societal relevance of invasion science by engaging stakeholders and decision-makers from administrative and political sectors in the host countries.

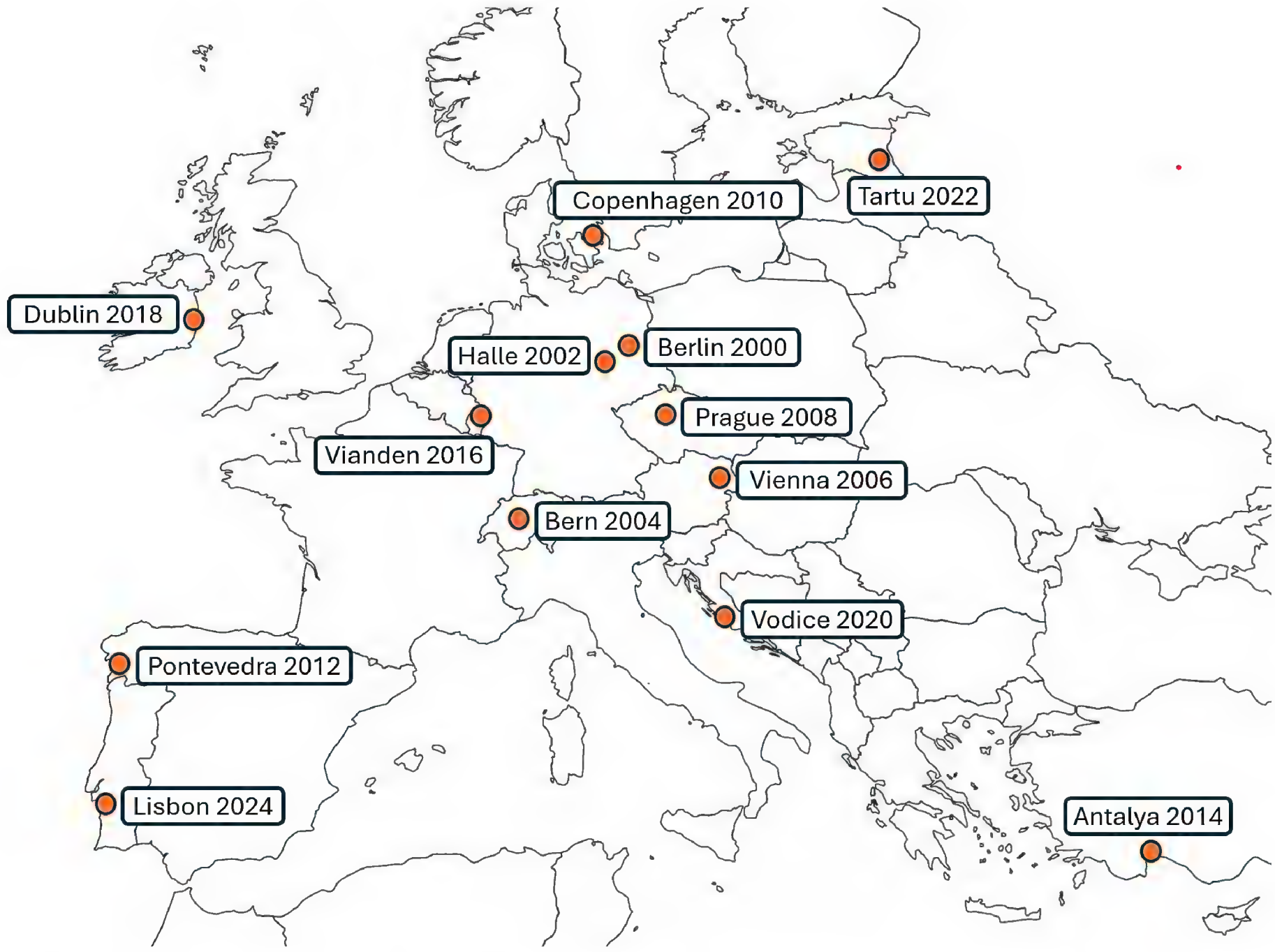

Figure 3. Venues of NEOBIOTA conferences from 2000 to 2024. Upcoming conferences are scheduled for Belgium (2026), Italy (2028), and Greece (2030).

Each conference has been independently organized by a local research group in collaboration with other scientific institutions or stakeholders at the local, regional, or national level and guided by the Neobiota Executive Committee. The local organizers established a scientific committee, which usually comprised Neobiota representatives and previous organizers, to provide guidance, continuity, and oversight.

Participation and internationalization

Over the course of the 20th century, scientific conferences became increasingly international in scope, with participation defined more by academic discipline than by nationality (Laqua et al. 2020). The number of participants who attended NEOBIOTA conferences rose steadily over time, from 100 attendees at the Berlin conference in 2000 to 421 attendees at the Lisbon conference in 2024 (Fig. 4). The 2020 conference in Vodice, held in a hybrid format due to the COVID-19 pandemic, experienced a temporary dip in attendance.

National diversity at scientific conferences is an important equity issue and matters for several other reasons (Scharkow and Trepke 2024). It stimulates scientific exchange and progress by broadening the range of topics and ideas presented, and, from a utilitarian perspective, the visibility of diverse participants may strengthen the academic labor market. Most attendees came from Europe, reflecting Neobiota's identity

Table 4. NEOBIOTA conferences 2000–2024: Venues, number of contributions, participants, countries represented, and associated publications edited by the local organizers.

Venue	Date	Key-notes	Main organizers	Talks	Posters	Participants	Countries	Book of Abstracts, Proceedings
Berlin, Germany	4.–7.10. 2000	0	Ingo Kowarik, Uwe Starfinger	27	24	100	9	Kowarik and Starfinger 2002, 2003
Halle, Germany	10.–12. 10. 2002	6	Ingolf Kühn, Stefan Klotz	32	15	81	12	Kühn and Klotz 2004
Bern, Switzerland	20.9.–1.10. 2004	4	Wolfgang Nentwig	36	84	185	25	Nentwig et al. 2005
Vienna, Austria	27.–29.9. 2006	4	Franz Essl, Frank Klingenstein, Wolfgang Rabitsch	38	206	344	46	Rabitsch et al. 2008
Prague, Czech Republic	23.–26.9. 2008	4	Petr Pyšek	43	183	274	39	Pyšek and Pergl 2009
Copenhagen, Denmark	14.–17.9. 2010	3	Johannes Kollmann	60	132	250	35	Kollmann et al. 2010
Pontevedra, Spain	12.–14.9. 2012	3	Laura Capdevila-Argüelles, Bernardo Zilletti, Montserrat Vilà	62	225	255	35	Zilletti and Capdevila-Argüelles 2014
Antalya, Turkey	3.–8.11. 2014	4	Ahmet Uludağ	116	205	167	39	Uludağ et al. 2014
Vianden, Luxembourg	14.–16.9. 2016	5	Christian Ries	56	156	260	39	Ries and Krippel 2016
Dublin/ Dun Laoghaire, Ireland	3.–7.9. 2018	6	Bruce Osborne	65	272	357	43	Osborne 2018
Vodice, Croatia	15.–18.9.2020	5	Sven Jelaska	57	89	155	33	Jelaska 2020, 2021
Tartu, Estonia	12.–16. 9 2022	6	Madli Linder	78	99	252	39	Linder 2022
Lisbon, Portugal	3.–6.9.2024	6	Pedro Anastacio, Filipe Ribeiro, Paula Chainho	199	163	421	47	Anastácio et al. 2024

as a European association; North America contributed the second-highest number of attendees, followed by Oceania, Africa, Asia, and South America. The number of countries represented at NEOBIOTA conferences increased rapidly, i.e., from nine in the year 2000 to 46 at the Vienna meeting in 2006. Since then, participation fluctuated between 35 and 47 countries; in total, 73 nations were represented in NEOBIOTA conferences. The highest number of participants were affiliated with institutions in Germany, the Czech Republic, Switzerland, Spain, and the United Kingdom (Fig. 4). This distribution likely mirrors variations in the tradition of invasion research. For example, the strong legacy of the Department of Invasion Ecology at the Czech Academy of Sciences explains the high representation from the Czech Republic (Pyšek et al. 2012). On average, only 9.9% of participants originated from non-European countries. Their proportion increased steadily from 0% to 21% by 2020, with a temporary dip due to the COVID-19 pandemic. Among these countries, the USA, South Africa, Australia, and New Zealand were the most represented by attendees.

Scientific contributions and addressed topics

In the early history of scientific conferences, presentations often provided comprehensive overviews of the current state of knowledge in a field. This format aimed to foster consensus, establish unified scientific positions, and facilitate the exchange

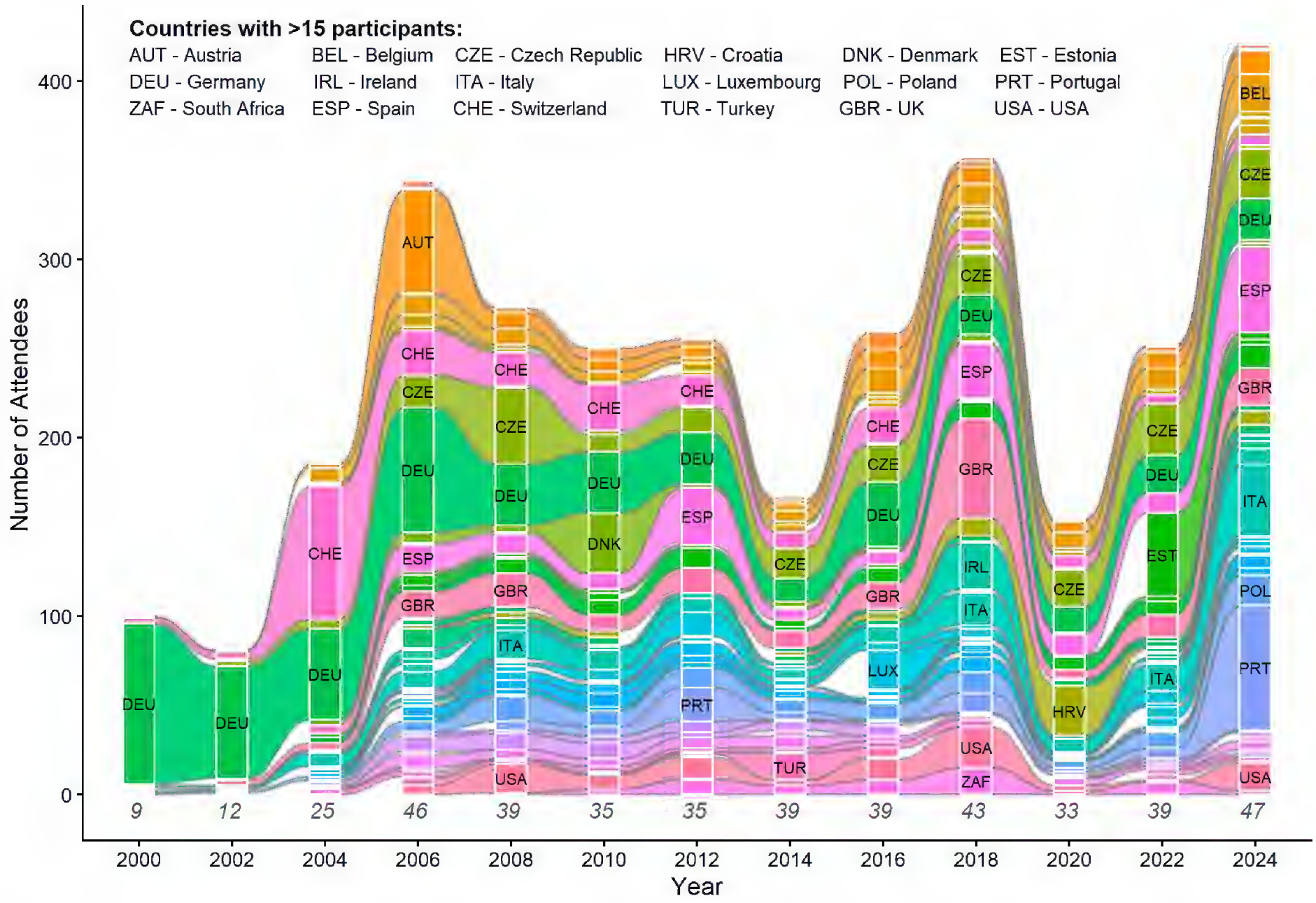

Figure 4. International participation patterns at the NEOBIOTA conferences over time. The alluvial plot illustrates how participant numbers from individual countries developed across conference years. Countries are represented by color-coded streams, with wider flows indicating higher numbers of attendees. Country abbreviations (ISO codes) are shown for countries with 15 or more participants. The total number of participating countries per year is displayed above the x-axis (see Suppl. material 1: table S2 for detailed information on all participants).

of ideas (Bigg et al. 2023). Accordingly, the first NEOBIOTA conference in Berlin (2000) sought to define the emerging field of invasion science and its main application areas. The program featured overview talks on plant and animal invasions in Germany, Austria, and the Nordic countries; evolutionary consequences of invasions; plant–animal interactions; introduction pathways via shipping; management approaches; cultural dimensions of alien species; and international legal frameworks.

At the second conference in Halle (2002), the program structure began to evolve: invited keynotes surveyed major subfields, allowing for more specialized contributions. This shift from broad syntheses to a diversified, bottom-up format mirrored trends that had taken decades in other international scientific associations (Bigg et al. 2023). In all conferences except those in Copenhagen, Pontevedra, and Lisbon, all talks were delivered in a single plenary session to foster cross-disciplinary communication and cooperation.

Although an important number of talks addressed interdisciplinary aspects during the first and last NEOBIOTA conferences, the proportion of talks focused on ecological research consistently dominated throughout the years (Fig. 5A). This trend reflects the historical roots of invasion science in ecology (Vaz et al. 2017) but also underlines the need to strengthen interdisciplinary approaches to fully capture the social-ecological nature of biological invasions and their impacts and management (Heger et al. 2021). Research topics have been diverse, with estab-

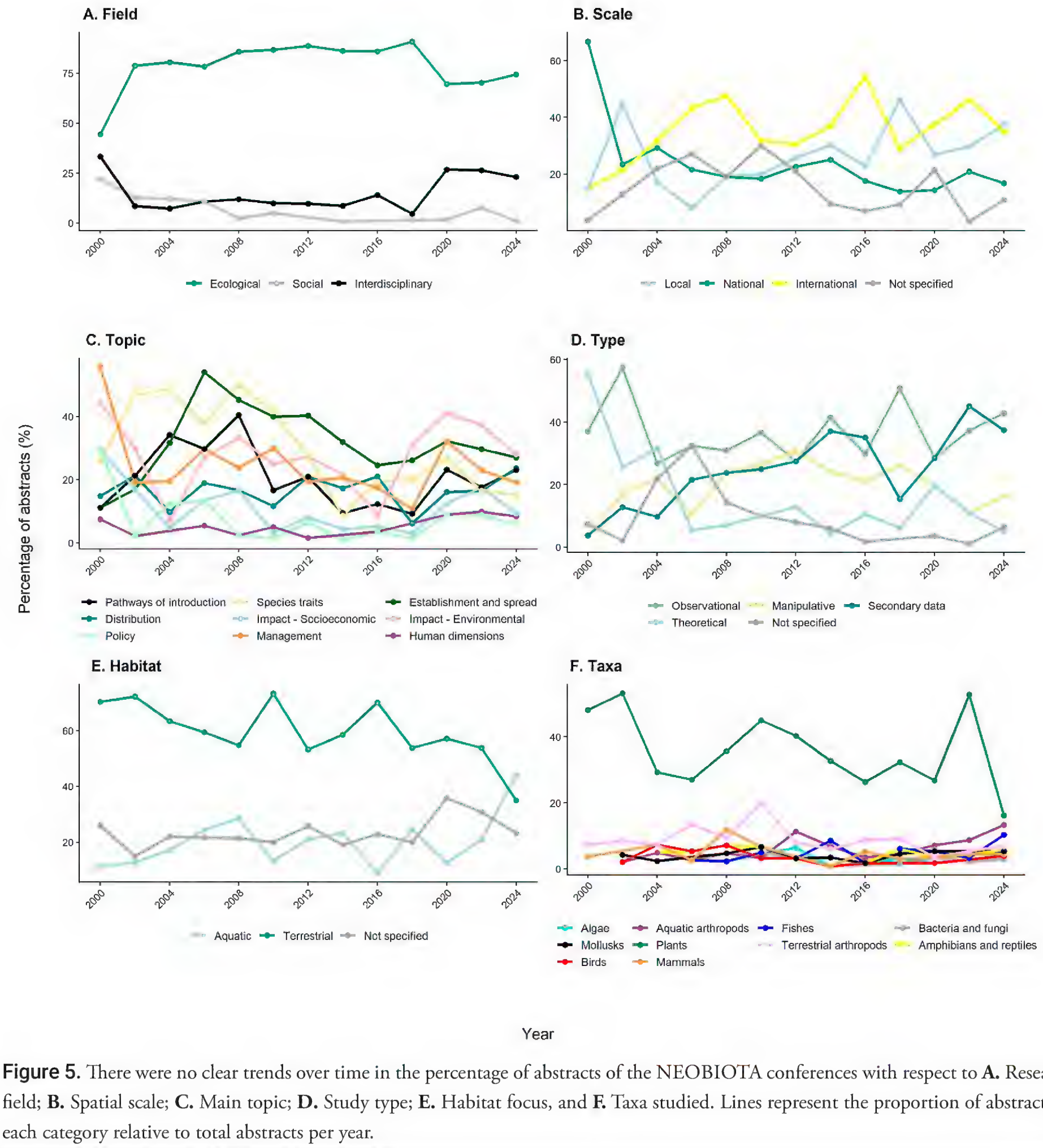

Figure 5. There were no clear trends over time in the percentage of abstracts of the NEOBIOTA conferences with respect to **A.** Research field; **B.** Spatial scale; **C.** Main topic; **D.** Study type; **E.** Habitat focus, and **F.** Taxa studied. Lines represent the proportion of abstracts in each category relative to total abstracts per year.

lishment and spread, environmental impacts, and species traits being among the most presented themes. More social topics such as policy, socioeconomic impacts, and other human dimensions have remained comparatively low throughout the years (Fig. 5C), reflecting the need for more research on the human and social dimensions of biological invasions (Shackleton et al. 2019).

According to the information provided in the abstracts, the spatial scale of the studies varied over time, with both local and international studies dominating during the last NEOBIOTA conferences (Fig. 5B). The presentation of studies based on secondary data (e.g., data collected from databases, published literature, and citizen science platforms) has increased over the years, while theoretical studies have become

less presented over time. Observational and manipulative studies remained relatively stable with slight fluctuations (Fig. 5D). Terrestrial habitats dominate throughout the entire period. However, as an exception, at the 2024 Lisbon conference organized by a marine group, a high percentage of studies focused on aquatic habitats (Fig. 5E). This led to the publication of a special issue on aquatic invasions in the NeoBiota journal (Anastácio et al. 2025). Plants have been the most frequently featured taxon, while other taxa, such as terrestrial arthropods, aquatic arthropods, fishes, and amphibians and reptiles, maintained low and relatively stable percentages (Fig. 5F). Mollusks, birds, mammals, algae, and bacteria/fungi have been less frequently featured.

Keynote talks

As with other major scientific meetings, NEOBIOTA conferences are organized around sessions covering the full spectrum of basic and applied invasion research, including governance, policy, and legislative implications (Suppl. material 1: table S3). Since Halle (2002), keynote talks have been a central feature, delivered by leading experts. By 2024, a total of 57 keynote presentations had been given.

Notably, 23 of the 57 speakers (40%) hailed from outside Europe, underscoring the role of invited keynotes in fostering global networking within the Neobiota community. Most keynote speakers came from the United States (12), the United Kingdom (10), and Germany (8). Therefore, speakers from high-income countries predominated, accounting for 92% of all keynotes; only five (7%) came from upper-middle-income countries (South Africa, Turkey, Brazil, Argentina, and Ecuador) and one from a low-income country (India).

Community building

"Building a sense of community and a collective identity seems to be one of the few roles that is still going strong and that sets scientific associations apart from universities, immersed in competition among themselves" (Delicado et al. 2014, p. 454). Community building thrives on face-to-face interaction, which is crucial for the exchange of trusted knowledge (Bigg et al. 2023). Informal communication has long been recognized as essential in complementing formal presentations (Bigg et al. 2023). Charles Darwin's remark about the 1847 meeting of the British Association for the Advancement of Science captures this dynamic:

"We enjoyed (my wife and I) our week beyond measure: the papers were all dull, but I met so many friends and made so many new acquaintances … and took so many pleasant excursions" (cited in Bigg et al. 2023, p. 7).

NEOBIOTA conferences blend a rigorous scientific program with diverse opportunities for informal exchange, i.e., welcome receptions, field excursions, poster sessions, extended coffee breaks, and social events. Although systematic data are lacking, cross-cutting interactions among researchers from different countries, disciplines, and career stages likely foster scientific sociability and a shared identity. Conferences are particularly important for the academic socialization of early-career scholars (Kuzhabekova and Temerbayeva 2018; Hauss 2021). Postdocs particularly benefit from accessing unpublished information, deepening personal networks, initiating collaborative publications, and learning about funding and job opportunities (Hauss 2021).

Ultimately, NEOBIOTA conferences have also served as the forum for the Association's organizational development, including the formation and election of the Neobiota Board and Council during conference gatherings and co-hosting NeoBiota editors' meetings in the early years of the journal.

Equity issues

Access to international conferences is rarely equitable, with multiple dimensions of inequality, including limited recognition and financial barriers for scientists from less-wealthy countries. Based on the World Bank's income classification (2026 fiscal year), participants from non-high-income countries were markedly underrepresented at the NEOBIOTA conferences, averaging only 7.4%. This is likely due to financial and formal restrictions in entering a country (e.g., visa issues and lack of travel funding).

Scientific conferences often mirror broader gender disparities in academia, with men disproportionately occupying prestigious roles (Boncourt et al. 2023). NEOBIOTA conferences are no exception, although trends have improved in recent years. Keynote speakers are selected by the Scientific Committee in coordination with local organizers. An analysis of given names suggests that approximately one-third (31%) of 57 keynote speakers over the past 25 years have been women (Suppl. material 1: table S3). Encouragingly, since the Vianden conference (2016), gender parity in keynote invitations has nearly been achieved (Fig. 6). Session chairs represent another prominent role. Of the 166 sessions for which the chairpersons were known, one-third (34%) were chaired by women and two-thirds (66%) by men (Suppl. material 1: table S4). Since the Dublin conference (2018), this ratio has moved to parity (Fig. 6).

Leadership within the Neobiota Association has alternated between genders (Table 2): a male coordinator/president led for the first 15 years, followed by more

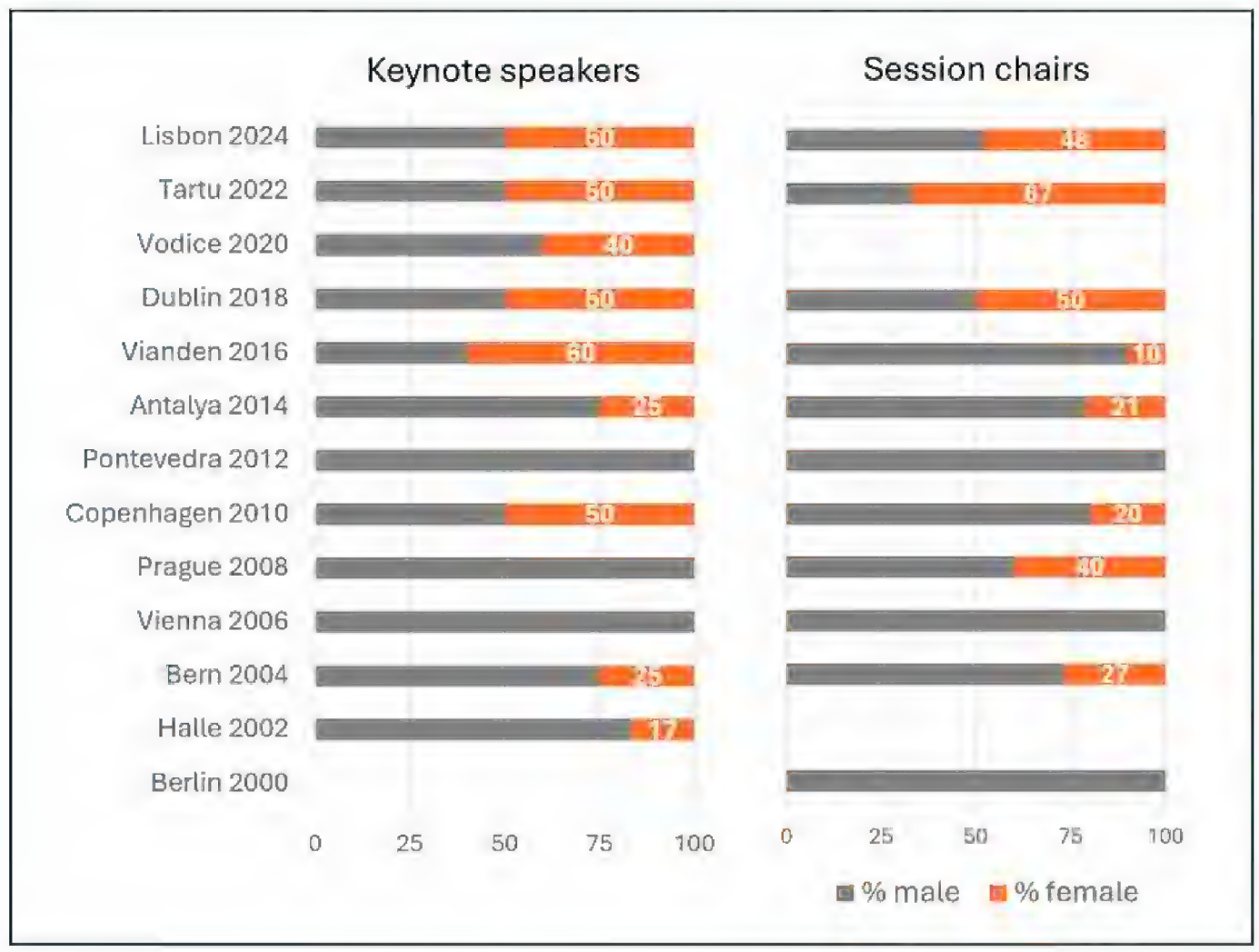

Figure 6. Gender representation among keynote speakers and session chairs at NEOBIOTA conferences 2000–2024. Gender was determined based on given names. No keynotes were delivered in Berlin 2000; blank fields indicate missing data.

than a decade of female leadership, and male leadership again since 2024. Of the 21 individuals elected to the Neobiota Board so far, one-third have been women. Such visible role models are crucial for younger researchers of all genders, demonstrating that sustained academic success in invasion science is attainable.

Similar patterns are observed in the editorial leadership of academic journals in invasion science. For example, the journal Biological Invasions recently reported imbalances in the composition of its editorial board (Kuebbing et al. 2022). As of January 2021, over 60% of editors identified as male. These examples from societies, conferences, and scientific journals underscore the importance of sustained, intentional action to promote equity and diversity in invasion science. Representation in prominent roles—whether on conference stages or in editorial offices—not only reflects the values of the scientific community but also shapes whose voices and perspectives guide the field's future.

As in the broader scientific community (Lieurance et al. 2022; Boncourt et al. 2023), the participation of underrepresented groups at NEOBIOTA conferences is increasing. Nonetheless, disparities remain. While progress toward gender equity in visible roles has accelerated since 2018, sustained improvement will require proactive efforts to include diverse voices.

Outreach to the public and policymakers

Schofer (2003) described the science-society interface as one in which scientists largely framed problems, expert knowledge informed government decisions, and scientific discourse shaped policy debates. While these dynamics remain visible in invasion science, contemporary approaches place much stronger emphasis on the involvement of local and Indigenous stakeholders in both problem definition and management (Caceres-Escobar et al. 2019; Brondízio et al. 2021).

From the SCOPE project on invasion ecology in 1982 onward, the field has been driven by both the need to understand drivers and impacts of biological invasions and the imperative to develop effective prevention and mitigation strategies. The 1992 Convention on Biological Diversity in Rio de Janeiro spurred a raft of international agreements committing governments to address invasive alien species (Shine 2007). Translating those commitments into binding national and EU legislation—ensuring effective implementation—has, however, remained a persistent challenge (Hulme et al. 2008, 2009; Essl et al. 2020).

Although scientific societies are often under-recognized as policy advisors (Delicado et al. 2014), this has not been the case for Neobiota. From its inception, the conference series has actively engaged policymakers by raising awareness of the societal relevance of invasions, proposing countermeasures, and stressing the urgency of legal and regulatory action at national and international levels. At the inaugural 2000 NEOBIOTA conference in Berlin, national conservation agencies helped to plan and fund the event and joined panel discussions. A coordinated press release secured broad media attention, including coverage in leading German magazines such as Der Spiegel, bringing invasion issues to a wider public audience.

Subsequent conferences continued this practice. Starting in Vienna (2006), official resolutions have regularly been issued, aimed at national bodies and the EU. Notable examples include:

- "Biological invasions need a strong legal framework at the European level" (Vienna 2006);

- "Recommendations from NEOBIOTA to the European Commission on the ongoing development of an EU Strategy on Invasive Alien Species" (Copenhagen 2010);
- "It is time to act! Biological invasions need a strong European legal framework urgently" (Pontevedra 2012); and
- "The time for action is NOW!" (Vianden 2016).

Through opening plenaries and subsequent media coverage, key messages have consistently reached beyond the specialist community. Even if it is difficult to attribute policy changes to any single conference, the EU has indeed made major strides—most notably Regulation (EU) 1143/2014, which mandates member states to control invasive species via the list of Invasive Alien Species of Union concern (Union List). Many scientists associated with Neobiota contributed evidence and expert advice during the scientific consultations that shaped this regulation (Carboneras et al. 2013; Genovesi et al. 2015). Currently, several scientists associated with Neobiota are members of the Scientific Forum of the European Regulation on Alien Invasive Species or have coordinated actions to identify potential species for risk assessment (Carboneras et al. 2018; Roy et al. 2019; Nunes et al. 2025). Other examples include the development of impact risk assessments adopted by policymakers, such as EICAT-IUCN (Blackburn et al. 2014; Hawkins et al. 2015; Kumschick et al. 2023); a prioritization scheme for risk assessment (Tanner et al. 2017); the development of a classification of pathways widely used in policy documents (Hulme et al. 2008); contributions to the Scientists' Warning initiative (Pyšek et al. 2020); the formulation of suggestions for the IAS goal of the Kunming-Montreal Global Biodiversity Framework (Essl et al. 2020); and, most notably, involvement as contributing authors to the IPBES Assessment on Invasive Alien Species and their Control and the resulting publications (Roy et al. 2023; Seebens et al. 2025).

Ultimately, the use of the term "neobiota" in several major European and international law databases indicates its outreach to legislation and legislation-related documents. For example, the FAO database includes 157 records (https://www.fao.org/common-pages/search/en/?q=Neobiota; accessed 2 February 2026), while the European Union's EUR-Lex database returns 32 results (https://eur-lex.europa.eu/search.html?scope=EURLEX&text=Neobiota&lang=en&type=quick&qid=1769286157717; accessed 2 February 2026).

Neobiota publications

Publications on biological invasions have steeply increased in number and impact since the 1990s (Richardson and Pyšek 2008; Kühn et al. 2011), with early findings scattered across a wide range of scientific journals (Campbell and Simberloff 2022). This fragmentation underscored the need for dedicated publication outlets, beginning with the launch of the journal Biological Invasions in 1999, followed by several other specialized journals (Table 5). Moreover, results on neobiota are published in top journals, and several invasion scientists are highly cited researchers (Pyšek et al. 2006).

Soon thereafter, the Neobiota series, edited by Ingo Kowarik and Uwe Starfinger, was established, focusing primarily on publishing conference proceedings. In addition to five volumes documenting contributions from NEOBIOTA conferences (Table 4, last column), the series included a volume on the use of regional versus

Table 5. Neobiota's contribution to publication formats in the field of biological invasions, compared to other journals (IF = impact factor).

Title	Type	Period	Related Association	Publisher	Open access	IF 2024
Biological Invasions	Journal	1999–		Springer	Hybrid	2.6
Neobiota	Publication series	2000–2008	Neobiota	–	No	–
Aquatic Invasions	Journal	2006–	International Society of Limnology, INVASIVESNET	REABIC	Yes	2.3
Invasive Plant Science and Management	Journal	2008–	Weed Science Society of America	Cambridge University Press	Hybrid	1.2
Management of Biological Invasions	Journal	2010–	INVASIVESNET	REABIC	Yes	1.2
NeoBiota	Journal	2011–	Neobiota	Pensoft	Yes	3.0
BioInvasions Records	Journal	2011–	INVASIVESNET	REABIC	Yes	1.5

introduced seed sources (Seitz and Kowarik 2003) and two standalone monographs: one on the predictability of biological invasions (Heger 2004) and another on insect communities associated with native vs. non-native trees (Goßner 2004).

NeoBiota as a new journal

Recognizing both the growing scientific relevance of biological invasions and the ongoing transformation of scholarly publishing—marked by the rise of digital platforms and open access—participants at the 2010 NEOBIOTA conference in Copenhagen resolved to launch an international, peer-reviewed, open-access journal under the name NeoBiota, edited by Ingolf Kühn and published by Pensoft Publishers, Sofia (https://neobiota.pensoft.net).

In their inaugural editorial (Kühn et al. 2011), the editors articulated the journal's mission to:

- Consolidate theoretical and applied research on biological invasions across all taxa and ecosystems;
- Investigate mechanisms of introduction, establishment, and spread;
- Examine ecological, evolutionary, economic, and societal impacts;
- Integrate ethical, legal, social, and policy perspectives; and
- Leverage innovative publishing technologies from Pensoft for fast peer review, publication, and data linking with biodiversity and bibliographic databases.

Since its launch in 2011, NeoBiota has published 511 articles as of mid-2025, with a notable increase in annual output after 2020. Led by Editor-in-Chief Ingolf Kühn, the journal is supported by a team of 75 subject editors (as of 2025), ensuring broad disciplinary, taxonomic, and geographic representation. In 2024, four Co-Editors-in-Chief were appointed alongside Ingolf Kühn to reflect the increasing diversity of the field: Phillip Hulme, Andrew Liebhold, Ana Novoa, and Tammy Robinson-Smythe. The journal has been indexed in Web of Science (Clarivate) since 2016 and currently holds the highest impact factor in the field of invasion science (Table 5). However, the impact factors of all invasion journals are relatively modest. This may be because article types that are cited particularly frequently, i.e., general papers and syntheses, are often published in other, more general top journals (Pyšek et al. 2006).

We conclude that by establishing and continuously developing dedicated publication outlets since the early 2000s, the Neobiota association has significantly contributed to the rapid and open dissemination of research on biological invasions. These efforts have fostered interdisciplinary exchange and supported the global integration of scientific knowledge, policy, and practical management.

Conclusions and outlook

Within a quarter of a century, the Neobiota association that was founded in 1999 by 24 scientists has evolved from a small German initiative into a resilient and vibrant international scientific community in invasion science. Rooted in Europe yet connected worldwide, Neobiota has successfully established a strong and enduring network of researchers across disciplines, taxa, and regions. Looking back, Neobiota's main achievements include:

- Bridging disciplinary and geographical barriers by overcoming long-standing obstacles to collaboration among scientists studying different organism groups, landscape systems, spatial scales, and methodological approaches—from natural and social sciences to governance;
- Fostering scientific exchange and personal interaction. The biennial NEOBIOTA conferences provide an essential arena for informal exchange and scientific debate, engaging participants at all career stages—from early-career researchers presenting poster abstracts to internationally renowned keynote speakers;
- Driving internationalization. With participants affiliated with institutions from 79 countries in the period 2000–2024, Neobiota has transcended national research boundaries and become a hub of globally networked European research on all aspects of biological invasions;
- Advancing knowledge on invasion science and research dissemination. Building on its initial publication series, Neobiota launched the open-access journal NeoBiota in 2011, which has since become the leading international outlet for invasion science; and
- Engaging in policy and practice. Through resolutions and the personal commitment of its members, Neobiota has provided scientific advice that supported legal frameworks at European and national levels.

In light of the shortcomings identified in our analysis, several perspectives for further development emerge. One important avenue concerns the structure of future NEOBIOTA conferences, where socio-ecological contributions could be solicited more proactively and their visibility enhanced, for example by strengthening dedicated sections and attracting keynote speakers with strong profiles at the science–policy–society interface. A second, equally important aspect relates to equity and inclusion. The efforts initiated to address inequity issues should be pursued consistently, while at the same time new and innovative approaches should be explored to further increase the participation of underrepresented groups. Addressing these challenges will be essential to ensure that Neobiota continues to evolve as a scientifically robust, socially relevant, and inclusive platform.

In a rapidly changing world, fundamental questions in invasion science remain at the forefront: What are the feedback effects between species introductions and

spread and the evolutionary, ecological, social, and economic factors that both drive and respond to these invasions? Which management responses and global generalizations are most appropriate, and where are region-specific solutions required? Research and the measures built upon have often focused on the mechanisms and negative consequences of the introduction and spread of introduced organisms. Related questions remain as relevant as ever. However, the question of what positive effects introduced species might have in a changing world is becoming more significant, as is how we can better understand and shape the coexistence of humans, native, and introduced organisms.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Use of AI

ChatGPT was used for linguistic correction.

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Author contributions

Conceptualization: IKo, AN, PP; Methodology: IKo, AN, PP; Formal analysis: ABG, PG, TH, IKo, AN; Investigation: IKo, AN; Data curation: ABG, PG, TH, IKo, AN; Writing– original draft: IKo; Writing – review and editing: ABG, GB, FE, PG, TH, IKo, IKü, AN, PP, US, MV.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

Supplementary tables

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